

On January 16, 1915, at noon, a 22°-halo was observed. At 12:20 p. m., an arc appeared about 46° above the sun, having the colors of the circumzenithal arc, but apparently concave toward the sun. At the same time the upper portion of the 22°-halo became brighter, and assumed the form indicated in figure 2. The east parhelia made its appearance at about 1:20 p. m. There was an intensely bright, white area just at and above the juncture of the 22°-halo and its tangent arcs. The colored arc faded at 1:45 p. m.; the upper part of the 22°-halo was still visible at 3:30, but disappeared soon after. Temperature, 35°F.; wind, S. Rain began after an interval of 17 hours and fell on the nine succeeding days.

CUMULUS OVER A FIRE.

By EDW. N. MUNNS.

[Dated Converse Experiment Station, Redlands, Cal., Aug. 5, 1915.]

During a brush fire on August 5, 1915, a cumulus cloud developed at the head of the smoke. The cloud appeared first at 3:05 p. m., lasting 20 minutes. It reappeared at 4:55 p. m., and lasted 12 minutes. The cloud was a typical cumulus, and formed close to 1,000 feet above the fire area.

ELECTRICITY OF ATMOSPHERIC PRECIPITATION.¹

By G. C. SIMPSON.

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While there are still certain questions relating to the electrical state of precipitation which have not been answered definitely, the broad features are now generally agreed upon by all observers. To account for these features two theories have been put forward: (a) The influence theory of Elster and Geitel; and (b) Simpson's "breaking drop" theory. In the present paper these two theories are considered, particularly with reference to the manner in which they will explain the observed facts. Elster and Geitel's influence theory (a) is based upon the idea that small water drops can come into electrical contact with large ones without uniting with them. Simpson considers that this supposition is far from established, and further suggests that even if sound it will not satisfactorily account for the electrical phenomena observed during rain. When the breaking-drop theory (b) was first put forward, evidence was adduced to show that it fully accounted for the electrical phenomena found with thunderstorms, but nont Thunderstorm rain and snow were not so fully dealt with. There has been some doubt as to whether breaking of drops does actually occur with ordinary steady rain, and without such breaking the theory fails. Evidence is brought forward to show that such breaking of large drops into small ones does occur in a gusty wind and will probably occur also to some extent in a still atmosphere, and this being granted, it is found that the theory will satisfactorily account for the changes of potential gradient which occur near the ground during rain in addition to explaining the charge on the rain itself. With regard to snow, it is suggested that the rubbing together of the flakes will produce electrification in the same way that Rudge has found electrification to be produced in

dust clouds, and this action will correspond with the breaking of drops in the case of rain.²—*J. S. Dines.*

AURORA OBSERVATIONS IN 1913.³

By C. STÖRMER.

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Although only a part of the material obtained on the expedition to Bossekop in 1913 has been worked up, the author has now details of about 600 very exact measurements of the altitude of the aurora and of its positions in space, all determined from photographs taken simultaneously from the two stations, Bossekop and Store Korsnes, lying about 27.5 kilometers from each other in a north and south line, and connected by telephone for direction of the observations. A notable result is the consistency with which the lower limit of altitude for the auroras is found to be from 90 to 100 kilometers.

The pictures of the auroral draperies on March 11–12, 1913, have been examined for the purpose of determining the nature of the discharge. For this magnetograms for the same epoch were obtained from the observatory at Haldde, about 13 kilometers west of Bossekop. Marked perturbations were visible on the magnetograms, showing that the magnetic action was so directed that it had components pointing to the north, west, and upward. Assuming that the electric corpuscles descend into the atmosphere from without, along the magnetic lines of force, forming auroral rays which combine to form the drapery, we can find by a simple application of Ampère's law that it seems to be proved that the aurora was caused by positively-charged electric particles. Diagrams are given in illustration of this view.—*C. P. Butler.*

THE GREAT AURORA OF JUNE 16, 1915.⁴

By E. E. BARNARD.

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A very remarkable exhibition of auroral activity was observed at the Yerkes Observatory on the night of June 16, 1915. Starting in the form of a strong low-lying arch without streamers, the activity gradually increased until the brilliant glow reached the pole, the lower portions being broken with bright moving masses and the upper part being double. After dying down, the phenomenon was repeated some hours later, and then the arch structure gave place to long ascending streamers, quick waves of auroral light rising to the zenith with remarkable rapidity. These continued for over an hour until further observation was interrupted by dawn. The maximum intensity occurred about 8:15 a. m., G. M. T., on June 17. A few of the brightest masses could be detected 20 minutes after dawn. There was little color in the display at any time, although a few of the streamers gave indications of a pink tinge. Photographs of the sky taken during the display were found to be badly fogged by the auroral light, which seemed to be more actinic than moonlight.

Widespread effects on telegraph systems appear to have occurred at the same time as the aurora. On the other hand wireless signals appear to have been normal throughout the period of the maximum display.—*C. P. Butler.*

¹ A summary of Simpson's previous conclusions will be found in this REVIEW, June, 1914, 42: 348.—*C. A. Jr.*

² Terrestrial Magnetism, March, 1915, 20: 1–12.

³ See Nature (London), July 15, 1915, 95: 536–537.

⁴ See Phil. Mag., London, July, 1915, 29: 1–12.